

## WHAT IS CLAIMED IS:

- 5        1.        A phacoemulsification system comprising:  
         a phacoemulsification handpiece including a  
cutting tip ultrasonically vibrated by an ultrasonic  
transducer;  
         a power supply for driving said ultrasonic  
10 transducer at a resonant frequency of the transducer  
and cutting tip and varying driving power to the  
transducer, in response to loading of said cutting  
tip, by phase shifting voltage and current supplied to  
the transducer.
- 15        2.        The system according to claim 1 wherein said  
power supply comprises:  
         a resonant output circuit connected to the  
ultrasonic transducer and having an output voltage and  
20 an output current oscillating therethrough;  
         a current sensor for providing a current  
signal corresponding to said output current;  
         a voltage sensor for providing a voltage  
signal corresponding to said output voltage;  
25        a bridge driver for controlling said  
resonant output circuit, said bridge driver being  
responsive to driver signals;  
         control circuitry for producing an amplitude  
command in response to the current and voltage signals  
30 and a frequency command; and  
         phase shift circuitry responsive to the  
frequency and amplitude commands for producing the  
driver signals, in order to control power output of  
said resonant output circuit through said bridge  
35 driver, by phase shifting the output voltage of one  
side of the bridge driver with respect to another side  
of the bridge circuit.

3. The system according to claim 2 wherein said bridge driver provides a square wave to said resonant output circuit.

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4. The system according to claim 3 wherein said bridge driver comprises a full-bridge invertor.

5. The system according to claim 4 where said resonant output current includes a step-up transformer.

6. The system according to claim 5 wherein said step-up transformer includes a primary winding connection to said bridge driver.

7. The system according to claim 6 where said step-up transformer includes a secondary winding connected to an inductor of a parallel resonant circuit in order that any transformer leakage adds to the total inductance.

8. The system according to claim 7 wherein said phase shift circuitry produces a copy of the frequency command which is shifted in phase based on the amplitude commands and inverted to produce four driver signals.

9. The system according to claim 8 wherein said copy of the frequency command is shifted between 0 and 180 degrees based on the amplitude command of 0 to 100 percent from said control circuitry.

10. A phacoemulsification system comprising:  
a phacoemulsification handpiece including cutting tip ultrasonically vibrated by an ultrasonic transducer;

a resonant output circuit connected to the ultrasonic transducer and having an output voltage and an output current oscillating therethrough;

5 a current sensor for providing a current signal corresponding to said output current;

a voltage sensor for providing voltage signal corresponding to said output voltage;

10 a bridge driver for controlling said resonant output circuit, said bridge driver being responsive to driver signals;

control circuitry for producing an amplitude command in response to the current and voltage signals and a frequency command; and

15 phase shift circuitry responsive to the frequency and amplitude commands for producing the driver signals, in order to control power output of said resonant output circuit through said bridge driver, by phase shifting the output voltage and output current.

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11. The system according to claim 10 wherein said resonant output circuit is configured for oscillating at a resonant frequency of the ultrasonic transducer and cutting tip.

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12. The system according to claim 11 wherein said bridge driver provides a square wave to said resonant output circuit.

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13. The system according to claim 12 wherein said bridge driver comprises a full bridge inverter.

14. The system according to claim 13 wherein said resonant output circuit includes a step-up  
35 transformer.

15. The system according to claim 14 wherein said step-up transformer includes a primary winding connected to said bridge driver.

5 16. The system according to claim 15 wherein said step-up transformer includes a secondary winding connection to an inductor of a parallel resonant circuit in order that any transformer leakage adds to the total inductance.

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17. The system according to claim 16 wherein said phase shift circuitry providing a copy of the frequency command which is shifted in phase based on the amplitude command and inverted to produce four  
15 driver signals.

18. The system according to claim 17 wherein said copy of the frequency command is shifted between 0 and 180 degrees based on the amplitude command of 0  
20 to 100 percent from said control circuitry.

19. The system according to claim 10 wherein said resonant output circuit is tuned to enhance open loop load response of the transducer.

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